

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

0 552 710 A1

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 93100715.7

(51) Int. Cl.⁵: **F16L 47/00, F16L 41/02,
F16L 41/08**

(22) Date of filing: 19.01.93

(30) Priority: 24.01.92 IT GE920004 U

(43) Date of publication of application:
28.07.93 Bulletin 93/30

(94) Designated Contracting States:
DE ES FR GB GR IT NL

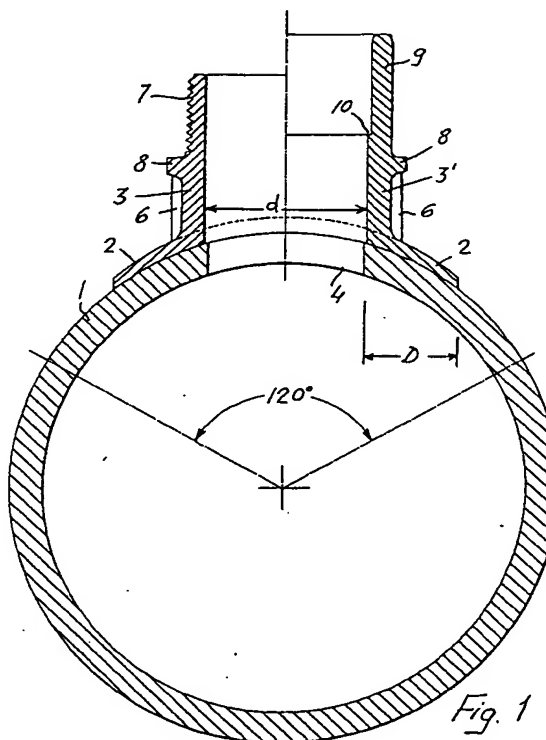
(71) Applicant: **TECNO PLASTIC S.r.l.**
Via Fontanelle, Località Seminella
I-16012 Sarisolla Busalla (IT)

(72) Inventor: **Tubaro, Federico**
Via Solimano 76/2
I-16030 Sori (IT)

(74) Representative: **Porsia, Bruno**
c/o Succ. Ing. Fischetti & Weber Via Caffaro
3/2
I-16124 Genova (IT)

(54) **Branch piece for plastics ducts or tanks.**

(57) The object of the invention is a branch piece for plastics ducts (1) or tanks, which may even be made at a later time, comprising a branch stub (3, 3') also made of plastics material, which is formed with a flange (2) whereby the branch stub is adhered or bonded to the duct (1) or tank outer surface. Either beforehand or subsequently, a bore is made in the duct (1) or tank wall, at the location where the branch stub (3, 3') is arranged. The size of flange (2) is so selected as to be the smallest possible, compatibly with the required mechanical strength and resistance to internal pressure.



EP 0 552 710 A1

The present invention has for its object a branch piece for plastics ducts or tanks, particularly for those containing fluids under pressure, of the type normally used in the fields relating to aqueducts, irrigation, industrial plant engineering, and the treatment of fluids in general, which branch piece can generally, but not indispensably, be provided at a later time, that is, on a seated duct or tank, by having a branch stub tightly attached to the outer surface of a duct or tank, which branch stub is also made of plastics material, preferably by injection molding, and through a flange which is shaped conformably to the duct or tank outer surface, is caused to seal thereagainst, as well as by having a matching bore made in the duct or tank wall, either beforehand, or preferably after the attachment of the branch stub.

In a known branch piece of this kind, a branch stub was attached to a duct with the aid of means, such as bracket and bolt means, or the like, which embraced the duct. These means are rather complicated and expensive, and above all have the disadvantage of requiring an access to the duct, diametrically opposite to the branch stub, but this was not always possible, or needed additional work.

Another known solution often used with PVC ducts, consists in cross-cutting a duct and joining again the two duct sections by means of a reduced T-shaped pipe union, with its two opposite, coaxial stubs tightly connected to the duct sections, and its reduced transverse stub forming the branch piece. This solution has the inconvenience that generally it cannot be carried out after the duct has been seated, and that it entails the cost of cross-cutting the duct and using expensive means.

The invention aims to eliminate any inconvenience arising from the known embodiments, and the object thereof is to render the branch pieces, of the kind as stated at the outset, simpler and less expensive, whereby the attachment of a branch piece will be facilitated, and a perfectly tight seal, as well as a very good mechanical (fastening) strength and resistance to internal pressures, will be ensured.

This object is attained by the invention substantially by the feature that a branch stub is attached to a duct or tank by causing it to adhere to the duct or tank wall.

According to the preferred bonding method, a branch stub is suitably attached to a duct or tank by causing its flange to adhere to the duct or tank outer surface.

According to a preferred, further feature of the invention, the width of the flange of a branch stub, that is, the distance between the inner and the outer edge of the branch stub flange, should not be greater than the inside diameter of the branch stub

at the to-be-bonded end thereof. Preferably, this distance may be varied between a minimum value, corresponding to half the inside diameter of a branch stub at the to-be-bonded end thereof, and a maximum value, corresponding to the inside diameter of the branch stub. Such a preferred range of width of the branch stub flange is based on the acknowledgement that in order to obtain a perfect, that is, continuous and tight bonding of a branch stub flange to the outer surface of a duct or tank, the to-be-bonded flange area should be the smallest possible, compatibly with the desired or required mechanical strength and resistance to internal pressure. In fact, the more reduced is the flange area (compatibly with the mechanical strength and pressure resistance values), the more precise will be the mating of the to-be-bonded flange inward surface with the duct or tank outer surface, (the effect of the inevitable manufacturing tolerances being thus diminished), so that the more continuous and uniform bonding and adhesion of these surfaces will be achieved.

In the instance of cylindrical ducts, a correspondingly curved shape is given to the flange of a branch stub, and in order to maintain a correct ratio of the diameter of a duct to the diameter of the bore for a branch stub, as well as to the width of the to-be-bonded flange area, the angle of the duct cross-section, over which extends the branch stub flange, should not be greater than a maximum value of 120° .

For the branch stub according to the invention, it is sufficient that substantially only that part of the outer surface of a duct, to which the flange of a branch stub is to be adhered, be clear and accessible. When the bonding method is followed, the branch stub and the duct may be of any suitable material, provided that an adhesive causing them to adhere to each other, will be available. Any suitable adhesive compatible with the materials to be bonded, and with the fluids conveyed through the duct, may be used. If, as it rather frequently occurs, a duct and a branch stub are made of PVC or ABS, currently available adhesives or solvents for PVC may be used, such as those known in the trade by the names TANGIT or BOSTON.

For the bonding operation, suitable auxiliary means may even not be needed, since, in some instances, it is sufficient to hold manually in place a branch stub on a duct, by exerting a light pressure on the branch stub, until the adhesive has set to a certain degree. In other instances, any suitable positioning and pressing means, and even makeshift means, may be used for this purpose.

According to one preferred embodiment of the invention, means may be provided on the outward side of the flange of a branch stub, such as two diametrically opposite pins, whereby the branch

stub can be tied to a duct, and the branch stub flange can be pressed against the duct outer surface, with the aid, for example, of an annular rubber band stretched around the duct and fastened to the pins, so that the positioning of the branch stub and the pressure for causing it to adhere to the duct is ensured, up to completion of the bonding process.

These and other features of the invention, and the advantages arising therefrom, will appear more in detail from the following description of some embodiments of the branch stub according to the invention, which are shown by way of non-limiting examples in the accompanying drawings, in which:

Figure 1 is a sectional view of a duct with a branch stub being bonded to the duct outer surface, which shows two different embodiments of the branch stub.

Figure 2 shows two other embodiments of the branch stub.

Figure 3 is a perspective view of the branch stub according to Figure 2, showing the branch stub in bonded condition and temporarily tied to a duct.

Figure 4 is a sectional view showing a further embodiment of the branch stub.

Figure 5 is a sectional view of a branch stub according to the invention, showing the branch stub attached to the flat surface of a tank wall.

Figure 6 is a sectional view showing still a further embodiment of the branch stub according to the invention, in which the branch stub axis is at an angle of 45° relative to the duct axis.

In the Figures, reference numeral 1 denotes a duct, particularly of plastics material. To provide a branch from duct 1, even at a later time, that is, after the duct has been seated, the flange 2 of branch stub 3, or 3', or 3'', or 3''', or 3'''' is caused to adhere to the peripheral outer surface of duct 1, and a bore 4 is subsequently, or beforehand, made in the wall of duct 1, at the branch stub location. The branch stub flange 2 is bent conformably to the outside diameter of duct 1. Preferably, the width D of the branch stub flange 2 may be varied between a minimum value, corresponding to half the width of the inside diameter "d" of branch stub 3, 3', 3'', 3''', 3'''' on a level with its flange 2, and a maximum value, corresponding to the inside diameter "d" of the branch stub.

In the embodiment according to Figures 2 and 3, two pins 5, or the like, are provided on the outward face of flange 2 of branch stub 3'', 3''', and are arranged in diametrically opposite positions on a plane crossing duct 1. Thanks to the provision of these pins 5, a branch stub 3'', 3''' can be tied to duct 1 by means, for example, of an annular rubber band 21, or the like, which is stretched around duct 1 and is fastened to pins 5, as shown in Figure 3.

This allows to have a branch stub 3'', 3''' hold in place on duct 1 and pressed thereagainst by its flange 2, up to completion of the bonding process, that is, until the branch stub is firmly attached to duct 1. Of course, the pins 5, or the like, may be also provided in any of the other embodiments of the branch stub according to the invention.

Also the branch stub 3, 3', 3'', 3''', 3'''' and its flange 2 are currently made of plastics material, particularly by injection molding, and preferably of the same plastics material as duct 1, and an adhesive or solvent suitable for the respective plastics material, is used for having the flange 2 of branch stub 3, 3', 3'', 3''', 3'''' bonded to duct 1. When a duct 1, and a branch stub 3, 3', 3'', 3''', 3'''' and its flange 2 are made of PVC, the adhesive to be used may be any available adhesive for PVC, such as the adhesives known in the trade by the names TANGIT or BOSTON.

According to a further, advantageous feature of the invention, in the instance of cylindrical ducts 1, and branch stubs with their flange being bent conformably to ducts 1, the branch stub flange 2 extends over the periphery of the cross-section of a duct 1 by an angle which does not exceed the maximum value of 120° , as shown in Figure 1.

The branch stub 3, 3', 3'', 3''', 3'''' according to the invention, can be attached not only to a cylindrical duct 1, but also to a duct having a polygonal cross-section, or a cross-section with at least one flat surface, to which such a branch stub is caused to adhere by its matingly flat flange. Moreover, the branch stub according to the invention, can be attached not only to a duct, but also to a tank of any shape and size. When the tank has a cylindrical shape, the requirements are similar to the requirements as described for duct 1.

Shown in Figure 5 is the embodiment in which a branch stub 3 is formed with a flat flange 102, and is fixed in position by its flange 102 being caused to adhere to the outer surface of a flat wall of tank 101, at the location of bore 104, to be made for a branch stub 3 either beforehand or after the branch stub 3 has been attached to tank 101.

In every one of the above described cases, the branch stub 3, 3', 3'', 3''', 3'''' and the duct 1 may be made of any suitable plastics material, and can be mutually bonded by means of a proper adhesive, such as ABS.

The branch stub 3, 3', 3'', 3''', 3'''' may be made in any suitable manner, and it may be, for example, fitted with any suitable means for connection to a pipe, or it may form an integral or complementary part of a pipe connector piece for connection of a rigid or flexible pipe, or of any device, such as a valve, or the like.

In the shown embodiments, the branch stubs 3, 3', 3'', 3''', 3'''' are all formed at their lower end

section adjoining their flange 2, with longitudinal, outward stiffening ribs 6. The branch stub 3, shown in the left-hand half of Figure 1, is formed at its free upper end section with an external thread 7, located inwardly relative to an underlying, outward annular collar 8. The branch stub 3' shown in the right-hand half of Figure 1, is instead formed with an upper end section 9 having a flat outer surface which extends past the annular collar 8, and with an internal step 10 for limiting the depth of connection with a pipe or pipe connector piece (not shown), to be fitted into the end section 9 of branch stub 3'. The outward collar 8 is for limiting the depth of connection with a pipe or pipe connector piece, to be threaded or fitted on the outside of the end section 7, 9 of branch stub 3, 3'.

The branch stub 3''' shown in the right-hand half of Figure 2, is formed with an internal thread 11, and with an internal step 12 which performs the same limiting function as the step 10. The branch stub 3'' shown in the left-hand half of Figure 2, is still provided with the internal step 12, but is formed with an external thread 13. The branch stub 3''' is also shown in Figure 3.

Shown in Figure 4 is a branch stub 3'''' which forms an integral part of a pressure connector piece for connection of a rigid or flexible pipe 14. This branch stub 3'''' is similar to the branch stub 3'', but is formed not only with an external thread 13 and an internal step 12, but also with an inner step 15 for an end edge of pipe 14 to abut thereagainst. This pressure connector piece includes a packing ring 16 arranged around pipe 14 and resting on the internal step 12 in branch stub 3'''. The packing ring 16 is compressed against the step 12 by a cylindrical inner spacer sleeve 17, and a pipe-clamping ring 18 formed with inward teeth, and with a conical outer surface cooperating with the matching, conical inner surface of an external ring nut 19 threaded on the external thread 13 formed in branch stub 3''', as shown in the right-hand half of Figure 4. With this arrangement, on the ring nut 19 being screwed down on branch stub 3''', the ring nut 19 will radially press inwardly by its conical inner surface the pipe-clamping ring 18, by being caused to act on the conical outer surface thereof, whereby the clamping ring 18 comes to be connected with pipe 14, and comes to be simultaneously driven axially toward the internal step 12 in branch stub 3''', whereby the packing ring 16 comes to be compressed through the cylindrical inner spacer sleeve 17, against the step 12. Thus, the branch obtained by means of a branch stub 3''', which is adhered or bonded to a duct or tank, is tightly connected with pipe 14. When the use of this branch is not required, the pipe 14 is taken off, and in place of the cylindrical inner spacer sleeve 17, there is fitted a closure cap 20

consisting, for example, of a spacer sleeve which is like the cylindrical spacer sleeve 17, but is provided with an intercepting end plate 120 made of one piece therewith, as shown in the left-hand side of Figure 4. The branch stub 3'''' which is adhered or is bonded to the outer surface of duct 1 or of a tank, thus comes to be tightly closed by this closure cap 20, but it can be opened again when needed.

In any embodiments of the invention, the flange 2 or 102 for attachment of a branch stub may have a rounded, oval, or polygonal shape. With oval or polygonal flanges, an average value, or the value referred to a circumscribed or inscribed circle, will be considered to be the flange width D.

The branch stub according to Figure 6, designated by reference numeral 30, is a modified embodiment of the branch stub 3' shown in Figure 1, and differs from the latter in that the axis of branch stub 30 is arranged at an angle other than the 90° angle shown in Figure 1. Otherwise, those parts which are like or perform an equal function, are designated in Figure 6 by the same reference numerals. In the example shown in Figure 6, the axis of branch stub 30 is arranged at an angle of 45° relative to the axis of duct 1. Of course, the axis of branch stub 30 may be arranged at any suitable angle, such as, particularly, of 60°, 75°, 87° 30', or the like.

According to an improved embodiment, in order to be enabled to make more easily and accurately a bore in duct 1, after the branch stub 30 has been fixed in position, this stub is fitted at its interior with a means for guiding a perforating tool.

The perforating tool guiding means is so provided that it may be caused to cooperate either with a drilling bit, for making a small sized, coaxial bore 4', or with a cup shaped borer with centering pin, for making a big sized bore 4 of a diameter substantially corresponding to the inside diameter of branch stub 30.

In this embodiment, the tool-guiding means is in form of a bit- or centering pin-guiding tubular element 31 arranged coaxially to branch stub 30 by its lower end resting on duct 1. The bit- or centering pin-guiding element 31 has a diameter which is much smaller than the inside diameter of branch stub 30, and substantially agrees with the diameter of a drilling bit for making a small or medium sized bore 4'.

The bit- or centering pin-guiding tubular element 31 is attached to the inside of branch stub 30 by a plurality of radially arranged connecting staples or by an end plate 32, whereby the flanged end edge of stub 30 facing duct 1, and the matching, lower end edge of said guiding tubular element 31 are mutually connected. The loose, upper end

edge of the bit- or centering pin-guiding tubular element 31 inside stub 30 is also formed with a conically flaring opening 131.

With the aid of the bit- or centering pin-guiding element 31, a bore can be made in duct 1 in an extremely easy and accurate manner, since the bit or centering pin is thus prevented from slipping on the outer surface of the wall of duct 1. It is possible to use drilling bits of a small diameter, which are passed through the central bore in the bit- or centering pin-guiding tubular element 31, or drilling bits of a greater diameter, which simultaneously with their drilling action, will either totally or partly erode also the bit- or centering pin-guiding element 31. It is also possible to use cup shaped borers with centering pin. The centering pin is then guided by the guiding element 31, and simultaneously with the duct 1 being thus perforated, the staples or the end plate 32, respectively for connecting or fastening the bit or centering pin-guiding element 31 to branch stub 30, are also taken off.

This type of branch stubs may be also used with advantage in discharge systems where pressure are considerably low. In such a particular application, the flanges by which the branch stubs 30 are adhered or bonded, may extend over the periphery of the cross-section of duct 1 by an angle even smaller than 90°.

Of course, the invention is not limited to the just described and shown embodiments, but comprises any embodiments attaining an equal utility, by using the same innovative conception. On the other hand, the embodiment of the pressure connector piece, as shown in Figure 4, and more particularly the possibility of having the inner spacer sleeve 17 thereof replaced with a closure cap 20, 120, may be used with advantage even independently from the branch piece being made in form of an adhered or bonded branch stub, wherefore the aforementioned features may be applied with advantage to any other type of pressure connector pieces.

Claims

1. A branch piece for plastics ducts or tanks, particularly for those containing fluids under pressure, of the type normally used in the fields relating to aqueducts, irrigation, industrial plant engineering, and the treatment of fluids in general, which branch piece can generally, but not indispensably, be provided at a later time, that is, on a seated duct or tank, by having a branch stub (3, 3', 3'', 3''', 3''', 30) tightly attached to the outer surface of a duct (1) or tank (101), which branch stub is made of plastics material, preferably by injection molding, and through a flange (2, 102) which is

shaped conformably to the duct (1) or tank (2) outer surface, is caused to seal thereagainst, as well as by having a matching bore (4, 4') made in the wall of duct (1) or tank (2), either beforehand, or preferably after the attachment of a branch stub (3, 3', 3'', 3''', 3''', 30), characterized in that the flange of branch stub (3, 3', 3'', 3''', 3''', 30) is caused to adhere to the outer surface of duct (1) or tank (101).

2. The branch piece according to claim 1, characterized in that the width of the flange (2, 102) of branch stub (3, 3', 3'', 3''', 3''', 30), that is, the distance between the inward and the outward edge of said flange (2, 102) does not substantially exceed the inside diameter of branch stub (3, 3', 3'', 3''', 3''', 30) at the flanged end edge thereof to be adhered, and this distance is preferably varied between a minimum value corresponding to half the inside diameter of branch stub (3, 3', 3'', 3''', 3''', 30), on a level with its flange (2, 102), and a maximum value corresponding to the inside diameter of branch stub (3, 3', 3'', 3''', 3''', 30).
3. The branch piece according to claim 1 or 2, for ducts (1) or tanks with a curved, particularly cylindrical, outer surface, characterized in that the flange (2) of branch stub (3, 3', 3'', 3''', 3''', 30) is bent conformably to the curved shape of the duct or tank outer surface, and extends over the periphery of the duct (1) or tank cross section by an angle not exceeding 120°.
4. The branch piece according to claim 1 or 2, characterized in that the branch stub flange (102) has a flat configuration, and is caused to adhere to a flat surface (101) of a duct or tank.
5. The branch piece according to claims 1 to 4, characterized in that means (5), particularly two diametrically opposite pin means, are provided on the outward face of flange (2) of branch stub (3, 3', 3'', 3''', 3''', 30), in a plane crossing duct (1), whereby a branch stub (3, 3', 3'', 3''', 3''', 30) can be temporarily tied to duct (1), in order to ensure that the branch stub be correctly positioned, and its flange (2) be pressed against the duct (1) outer surface, until the mutual bonding of flange (2) and duct (1) is accomplished.
6. The branch piece according to any of the preceding claims, characterized in that the branch stub (30) has its axis arranged at an angle other than 90°, particularly of 45°, 60°.

75°, 87° 30', relative to the axis of duct (1) or the flat surface (101) of a tank.

7. The branch piece according to any of the preceding claims 1 to 6, characterized in that inside of the slanted branch stub (30), bit- or centering pin-guiding means (31), extending from the flanged branch stub end edge to be attached to duct (1) or tank (101), are provided for guiding a drilling bit or a cup shaped borer with centering pin when a bore (4, 4') is being made in the wall of duct (1) or tank (101) subsequently to the branch stub (30) having been bonded to duct (1) or tank (101).
8. The branch piece according to claim 7, characterized in that the bit- or centering pin-guiding means (31) are made of one piece with the branch stub (30) and by the same manufacturing process, particularly by injection molding of branch stub (30).
9. The branch piece according to claim 8, characterized in that the bit- or centering pin-guiding means is in form of a bit- or centering pin-guiding tubular element (31) which is provided at the interior of branch stub (30) coaxially thereto, and extends from the flanged end edge of branch stub (30) to be attached to duct (1), the said bit- or centering pin-guiding tubular element (31) having a diameter which is considerably smaller than the diameter of branch stub (30), and having its lower end edge fastened to the flanged end edge of branch stub (30) to be attached to duct (1), by means of a plurality of radially arranged connecting staples, or by means of an end plate (32), which when a bore (4) is being made in duct (1) by a borer with centering pin, is taken off by this borer, while when a bore (4') of a small- or medium-size diameter is being made in duct (1) by a drilling bit, it is only the bit- or centering pin-guiding tubular element (31) that is taken off either totally or partly, or that is not taken off at all.
10. The branch piece according to claim 8, characterized in that the loose upper end of the bit- or centering pin-guiding tubular element (31) located inside branch stub (30), is formed with a conically flaring opening (131).
11. The branch piece according to any of the preceding claims 1 to 10, characterized in that the branch stub (3, 3'') is formed with an external thread (7, 13).

5

10

15

20

25

30

35

40

45

50

55

12. The branch piece according to any of the preceding claims 1 to 10, characterized in that the branch stub (3''') is formed with an internal thread (11).
13. The branch piece according to any of the preceding claims 1 to 10, characterized in that the branch stub (3', 30) is formed with an inner and outer cylindrical surface (9), which is to be bonded to a pipe or pipe connector piece fitted into or on this stub (3', 30).
14. The branch piece according to any of the preceding claims 1 to 13, characterized in that the branch stub (3, 3') is formed with an outward annular collar (8).
15. The branch piece according to any of the preceding claims 1 to 14, characterized in that the branch stub (3, 3') is formed with at least one external step which is for limiting the depth of connection with a pipe or pipe connector piece fitted on this stub (3, 3').
16. The branch piece according to any of the preceding claims 1 to 15, characterized in that the branch stub (3', 3'', 3''', 3''', 30) is formed with at least one internal step (10, 12) which is for limiting the depth of connection with a pipe (14) or a pressure connector piece (16, 17, 18) engaged with this stub (3', 3'', 3''', 3''', 30).
17. The branch piece according to any of the preceding claims 1 to 15, characterized in that the branch stub (3, 3', 3'', 3''', 3''', 30) is formed with spaced apart longitudinal stiffening ribs (6) at least over that section thereof which is adjacent to its flange (2, 102).
18. The branch piece according to any of the preceding claims, characterized in that the branch stub (3''') forms an integral part of a pressure connector piece for connection of a rigid or flexible pipe (14), the said connector piece comprising a pipe-clamping ring (18) formed with inward teeth, and with an external conical surface being caused to cooperate with an inner conical surface of a ring nut (19) which is threaded on the external thread (13) in branch stub (3'''), a cylindrical, inner spacer sleeve (17) being interposed between the pipe-clamping ring (18) and a packing ring (16) resting on the internal step (12) in branch stub (3'''), and the said spacer sleeve (17) being replaceable with a substantially equally sized closure cap (20) having an integral intercepting plate (120) at the head end thereof.

19. The branch piece according to any of the preceding claims 1 to 15, characterized in that this branch piece is used in drain ducts, the flange (2) of branch stub (3, 3' 3", 3"', 3''', 30) being bent conformably to the curved shape of the duct (1) or tank outer surface, whereby the flange extends over the periphery of the cross-section of duct (1) or a tank by an angle being smaller than 90°.

5

10

15

20

25

30

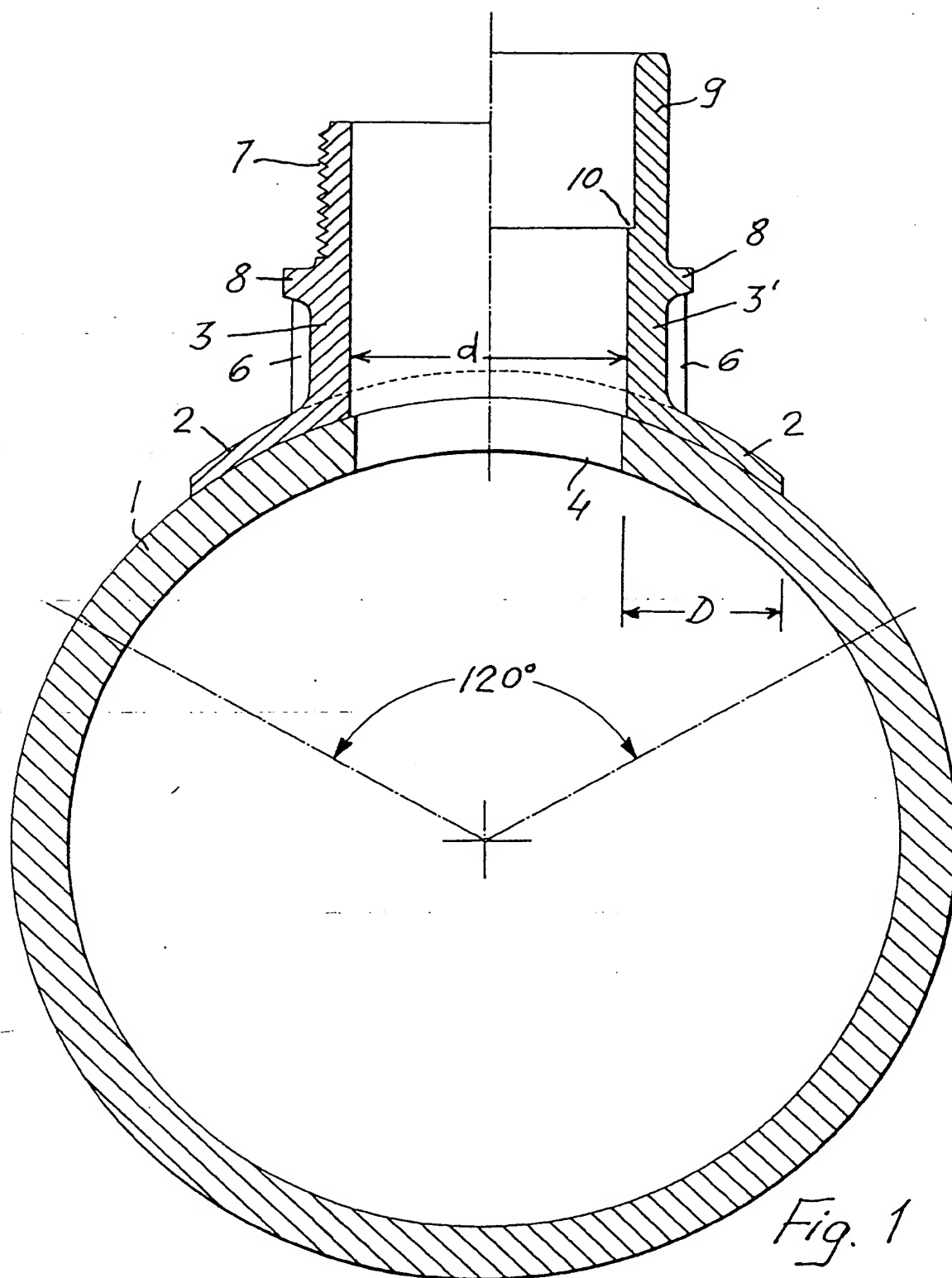
35

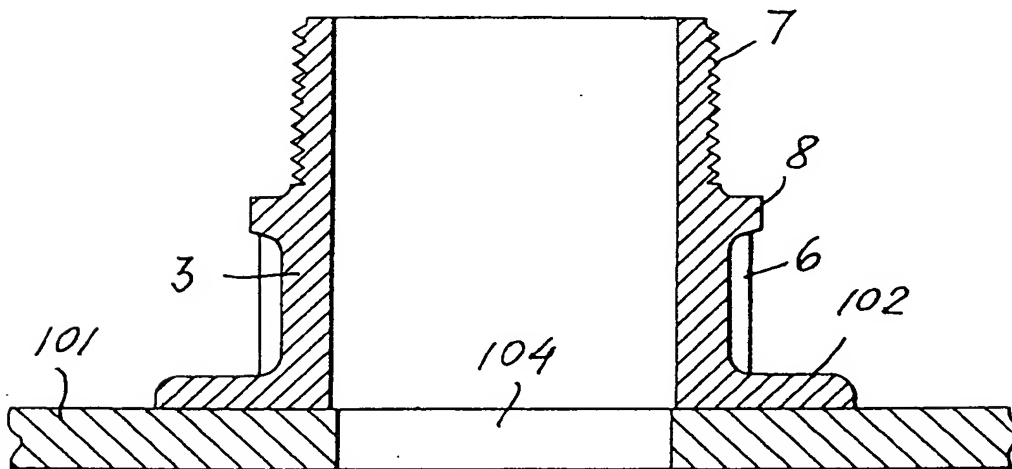
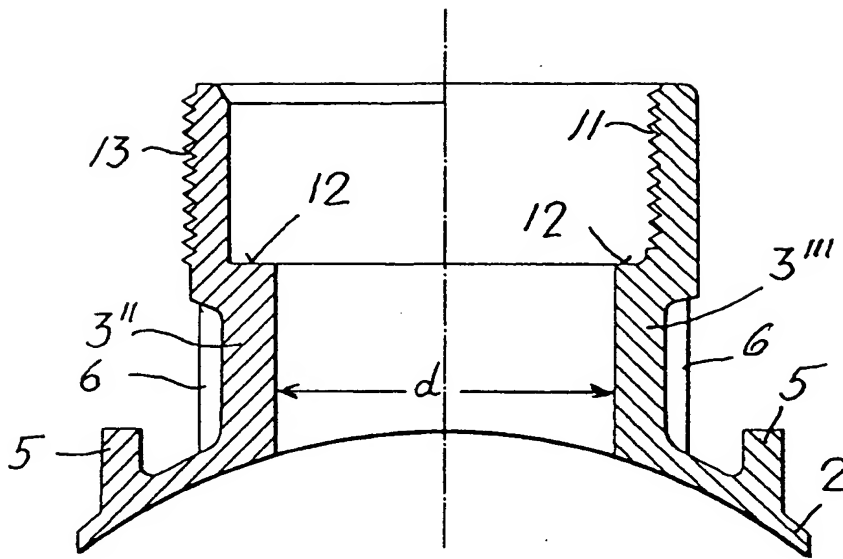
40

45

50

55





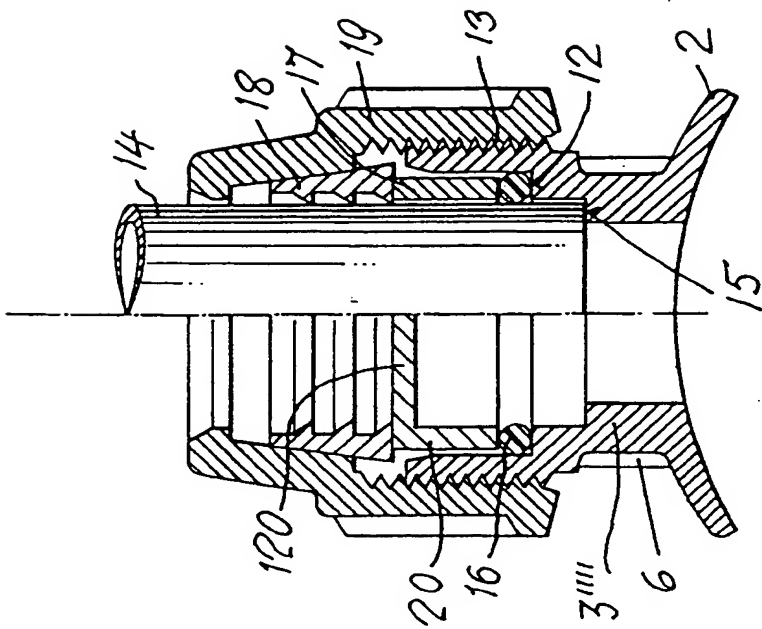


Fig. 4

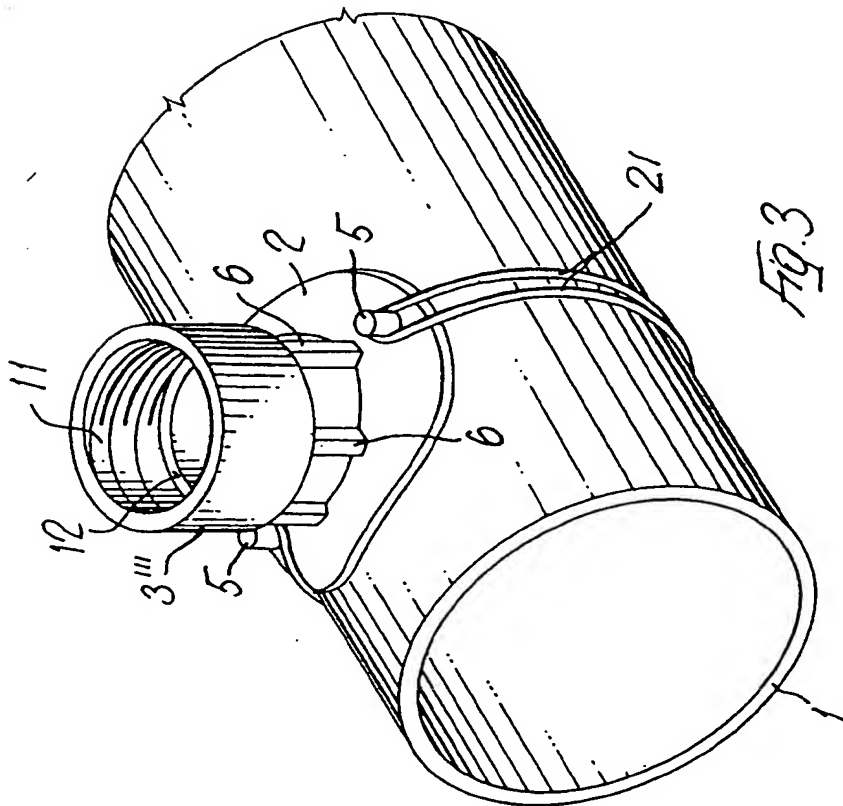
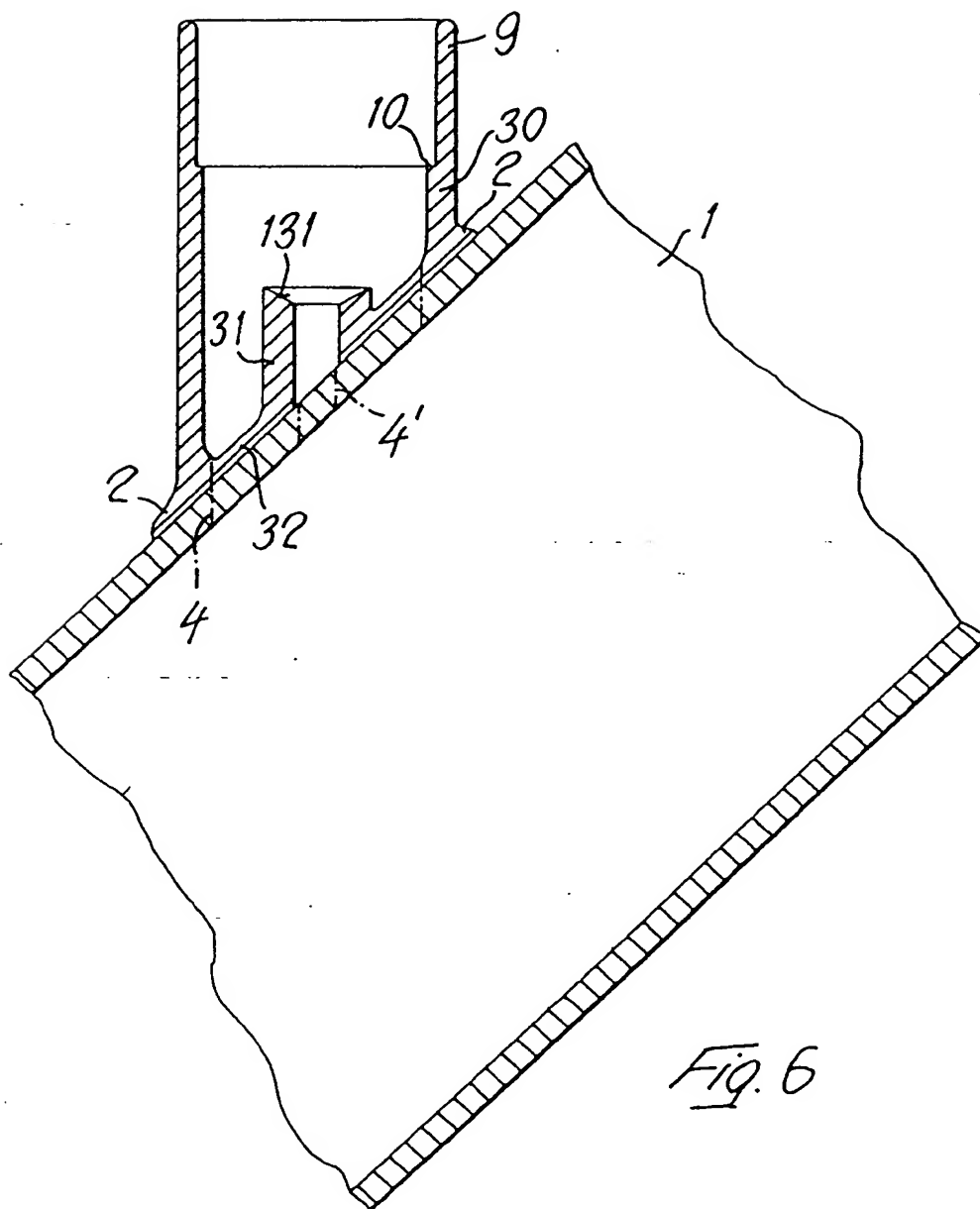


Fig. 3





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 10 0715

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	EP-A-0 341 494 (VON ROLL AG)	1, 2, 6, 13-15	F16L47/00 F16L41/02 F16L41/08
Y		3, 4, 11, 12, 16, 17, 19	
Y	EP-A-0 304 246 (WATER RESEARCH CENTRE)	3, 4, 11, 19	
A	* column 4, line 16 - line 19; claim 1; figures *	1, 2, 11, 19	
Y	US-A-3 649 055 (NILSEN) * figures 1, 3, 4 *	12, 16	
Y	GB-A-942 239 (MORRISON) * figures *	17	
A	GB-A-2 043 841 (LUCAS INDUSTRIES LIMITED) * figure 1 *	18	
A	US-A-1 883 439 (ADAMS) * the whole document *	-	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F16L
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20 APRIL 1993	Examiner BUDTZ-OLSEN A.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure F : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	